STEEL/NONFERROUS EARNINGS REPORT

DEBT RESTRUCTURING IS NOT JUST FOR THE GIANTS

NOVEMBER 10, 1982

IRON AGE

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DETROIT'S BIG CHANGES UNDER THE HOOD

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NOVEMBER 10, 1982

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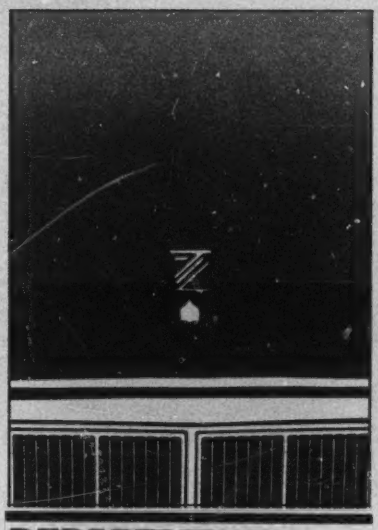

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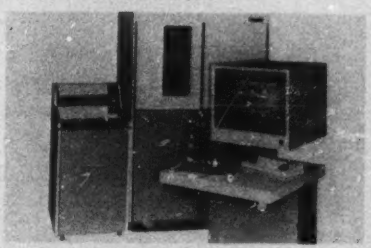

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STEEL AND NONFERROUS PRODUCE MORE RED INK

The steelmakers watched shipments decline in the third quarter, while nonferrous producers faced both depressed prices and lower sales volume.

By George J. McManus and Robert J. Regan

Third quarter financial results of steel companies were about as bad as had been expected.

Of the first 15 companies reporting, 13 lost money in the quarter. Even Carpenter Technology Corp., which has always been profitable, lost money in the third quarter.

United States Steel Corp. had an operating loss of nearly $290 million on its steel business. Bethlehem Steel Corp. had the largest net loss—$208 million. This was the second largest deficit in Bethlehem's history.

Among those reporting profits for the third quarter were Lukens Inc. and Nucor Corp. Tax credits of $764,000 swung Lukens into the black.

Nucor had a clear-cut profit of nearly $6 million. This was remarkable for a company operating in depressed and highly competitive markets. "We concentrate very hard on costs," said Samuel Siegel, financial vice president for Nucor. The company has been able to introduce a high degree of flexibility in its cost structure.

More typical of the industry as a whole is what happened to Republic Steel Corp. in the third quarter. Republic's shipments fell 16 pct from the poor second quarter. Dollar sales were off even more—over 20 pct.

The sharp dollar decline reflected "a negative swing in product mix and market pressures on prices in addition to the lower volume," said E. Bradley Jones, chairman of Republic. The net result was a net loss of more than $74 million for the company.

The 14 million tons shipped by the industry in the third quarter compared with 16 million tons in the second quarter of 1982 and with over 21 million tons in the third quarter of 1981. Price competition continued and any remaining oil country business disappeared.

Another factor in the third quarter was the Aug. 1 wage increase of 48¢ an hour. "Our huge steel segment losses are incurred in the face of rising hourly wage costs," said David M. Roderick, chairman of United States Steel Corp.

U. S. Steel cut its dividend in half, and Mr. Roderick noted that salary employees were sharing in the effects of bad times. "Wage earners must now join that effort or the basic steel industry has little prospect for sustained recovery," he said.

The start of the recovery has not yet been indicated by orders of U. S. Steel or others. "The business environment continued to worsen during the quarter and is not expected to improve in the last quarter," said Harry Holiday, chairman of Armco Inc.

At the moment, things are tough and steel companies are scrounging for cash.

"We see absolutely no change in the market," said Mr. Siegel of Nucor.

Steel executives are hopeful there is a change in the making. "The sequence of events necessary for a general business upturn is coming into place," said Mr. Jones of Republic.

Mr. Roderick feels declining interest rates "could help spark a modest consumer-led economic recovery beginning in the fourth quarter or in early 1983."

September auto sales were encouraging and the relative strength of the sheet market suggests the consumer sector is slowly reviving. With capital goods still sliding, however, fourth quarter prospects for steel are dim.

"All signs indicate that results from steel manufacturing operations in the fourth quarter will be even worse than the third," said Stephen A. Girard, chairman of Kaiser Steel Corp. Kaiser had a net loss of $24 million in the third quarter. The pre-tax loss of steel was $44.1 million.

One positive development is the recent agreement which limits carbon steel imports from Europe to about 5 pct of the U.S. market. Mr. Roderick said other limits must be established if this is to do any good.

"To this end," he said, "the corporation is looking closely at imports from Third World countries and Japan."

The Japanese have said their second half steel shipments to the U.S. will be down 50 pct from 1981. If that cut is already taking place, said an analyst, business conditions must be really awful. There has been no reflection of reduced imports in the orders of domestic mills, he added.

It is likely that Japan will agree to some kind of formal trade restraint. Even without this, said a domestic official, steel imports will be down 3 million tons next year.

At the moment, things are tough and steel companies are scrounging for cash. So far this year, U. S. Steel has taken in $750 million from the sale of assets. This is helping to reduce the $3 billion debt incurred in the acquisition of Marathon Oil. In the third quarter, U. S. Steel still had interest charges of more than $200 million.

Cost cutting continues. Inventories are being reduced below minimum levels. Inventory adjustments added $24 million to the net income of Armco Inc. in the third quarter.

This addition was more than offset by special charges of $70.6 million after taxes. A big item was $71.9 million due to writing down of Armco's investments in Falconbridge Dominicana. The company took a big write-off on raw materials in the second quarter.

Throughout the industry, people are taking a hard look at raw material policies. Domestic steel companies have traditionally relied on fixed commitments for iron ore. Either through direct ownership or take-or-pay contracts, the companies have been locked into domestic and Canadian ores.

This has been a problem in slack years like 1982. With rich ore deposits opening up in Brazil, American mills

Steel: The Red Ink Keeps Flowing

Millions of Dollars

	'82 E/S Pct	Earnings 3rd Q '82	Earnings 3rd Q '81	Earnings Pct Change	Sales 3rd Q '82	Sales 3rd Q '81	Sales Pct Change
USS	—	(82.40)	536.90	—	4,522.80	3,465.80	+30
Bethlehem	—	(208.9)	76.30	—	1,195.70	1,854.00	−36
Armco	—	(122.60)	67.10	—	1,202.90	1,743.40	−31
LTV	—	(58.3)	97.10	—	1,127.20	1,950.20	−42
National	—	(95.98)	34.58	—	803.00	1,078.33	−26
Inland	—	(45.10)	7.97	—	676.40	926.56	−27
Republic	—	(74.56)	92.73	—	592.76	744.87	−20
Total	—	(687.84)	912.68	—	10,120.76	11,763.16	−14
Cyclops	—	(1.47)	5.00	—	222.67	259.32	−14
Wheel-Pgh	—	(26.02)	4.07	—	193.97	282.98	−31
Interlake	0.8	1.40	12.30	−89	183.10	255.10	−28
Kaiser	—	(24.00)	21.55	—	172.10	295.45	−42
Nucor	4.9	5.99	6.14	−2.4	121.11	136.00	−11
Lukens	0.3	0.33	2.50	−86.8	117.30	126.23	−7.1
Carpenter	—	(0.33)	6.99	—	86.81	123.66	−30
Copperweld	—	(9.13)	10.11	—	74.52	161.43	−54
CF&I	—	(12.01)	9.30	—	65.48	187.31	−65
Laclede	—	(0.46)	(0.92)	—	42.86	61.52	−30
Eastmet	—	(.70)	(2.62)	—	37.03	68.37	−46
Phoenix	—	(10.26)	0.37	—	22.54	54.22	−58

Nonferrous: A Quarter Without Luster

Millions of Dollars

	Earnings 3rd Q '82	Earnings 3rd Q '81	Earnings Pct Change	Sales and Other Revenues 3rd Q '82	Sales and Other Revenues 3rd Q '81	Sales and Other Revenues Pct Change
Alcan	(15.0)	67.0	—	1,194.0	1,223.0	−2.4
Alcoa	(14.4)	81.3	—	1,145.2	1,284.3	−10.8
Amax	(97.1)	51.4	—	517.1	656.6	−21.2
Asarco	(56.8)	6.3	—	329.1	402.3	−18
Brush Wellman	3.2	3.8	−15.8	46.0	47.7	−3.6
Callahan Mining	1.4	3.3	−57.6	6.2	10.0	−38.0
Cominco	(19.8)	16.1	—	276.4	322.8	−14.4
Engelhard	17.1	17.8	−3.9	533.2	503.4	+5.9
Freeport-McRoran	34.3	44.3	−22.6	186.1	202.8	−8.2
Hecla Mining	2.4	(0.4)	—	13.0	16.9	−23.1
Inco	(66.4)	(29.5)	—	233.0	367.2	−36.5
Insilco	(3.7)	10.2	—	168.9	162.6	+3.9
Kaiser Aluminum	63.3	12.3	+414.6	895.6	794.3	+12.8
Martin Marietta	38.0	60.6	−37.3	892.0	835.9	+6.7
Olin Corp.	11.2	17.7	−36.7	433.9	489.9	−11.4
Phelps Dodge	(26.3)	2.6	—	206.3	344.2	−40.1
Phibro-Salomon	134.0	79.0	+69.6	6,538.0	6,563.0	−0.3
Reynolds Metals	(11.6)	29.5	—	759.3	902.7	−15.9

( ) denotes loss

Asarco. Net loss for 3rd quarter of 1982 includes extraordinary charge of $51 million related to Chapter 11 filing by 33 pct-owned Revere Copper and Brass, Inc. **Callahan Mining.** Net for 3rd quarter of 1981 includes a $2,570,000 gain from sale of investments. **Cominco.** Canadian funds. **Hecla Mining.** Loss for third quarter of '81 includes an extra charge of $78,000. **Inco.** Loss for third quarter of '81 includes $10,694,000 loss from discontinued operations. **Insilco.** Loss for third quarter '82 includes $10,630,000 loss from discontinued operations; net for third quarter '81 includes $805,000 gain from discontinued operations. **Kaiser Aluminum.** Results for third quarter '82 include a pre-tax non-recurring gain of $180.6 million from sale of natural gas rights; operating loss for the quarter was $107.3 million.

say foreign producers now have an edge on ore costs. It's argued that U.S. companies should rely more on open market purchases.

One of Nucor's advantages is that it relies on open market purchases of scrap. This provides a hedge against recessions. When demand for steel drops, the price of scrap tends to come down.

Also trending downward in a slump are Nucor's employment costs. Compensation for Nucor's officers is based to a large extent on bonuses that start when return on equity reaches 10 pct. The third quarter return was 8 pct. This was good by steel standards, but it meant the pay of officers was reduced something like 65 pct (including a 5 pct base pay cut).

Compensation of Nucor's department heads was reduced by a scheme that relates bonuses to return on division assets. The pay rates of direct production workers haven't been changed, but most of them are working only four days a week.

This flexiblity has made for financial strength. Nucor had a 4.9 pct return on sales in the third quarter. The company's debt was reduced from 28.3 pct of invested capital at the start of the year to 17.8 pct in the third quarter. Flowing from this was a reduction of interest charges from $3.9 million at the start of 1982 to $1.6 million in the third quarter of 1982.

"We make a lot of mistakes," said Mr. Siegel.

Nucor's well-being must mean that other people are making more, he said.

Nonferrous

The third quarter showing for leading nonferrous metal companies reads more like a casualty list than a tabulation of sales and profits.

Red ink ran from aluminum through copper to nickel and one company, Revere Copper & Brass Inc., filed for protection under Chapter 11 of the Bankruptcy Act.

Revere is a producer of primary aluminum and a fabricator of aluminum and copper products.

The nonferrous producers continued to reel from the one-two punch of depressed prices (below the cost of production in most cases, according to the producers) and lower sales volume.

Demand was down in key hard goods sectors of the economy, including cars, houses and major appliances. None showed any early reaction (during the third quarter, at least) to the anticipated stimuli from the mid-year tax cut and the more recent downtrend in interest rates.

The metal fabricators and manufacturers, most of whom have demand and profits problems of their own, continued to operate from hand-to-mouth inventory programs. Metals producers, meanwhile, wrestled with the problem of paring down their own stocks via stiff production cuts and conversion to cash at distress prices.

Although the aluminum producers (in the U.S., at least) have been cutting production severely as far back as late 1981, the effect has been very slow showing up in the inventory columns—in the U.S. or abroad. Going into September, for instance, the U.S. aluminum industry's inventory of ingot, mill products and scrap was down only 1 pct from the start of 1982.

Alcoa reported its first quarterly loss since it began reporting results on a quarterly basis.

Aluminum Co. of America (Alcoa) reported its first quarterly loss ($14.4 million) since it began reporting results on a quarterly basis in 1951. Third quarter shipments of aluminum products were about on par with the year-earlier period, but gross revenues were down nearly 11 pct, reflecting depressed price realizations.

Alcoa cut its quarterly dividend by a third, to 30¢ a share, as part of its cash-conservation program. It was Alcoa's first dividend cut in 43 years.

Alcan Aluminium Ltd. sustained a $15 million loss in the third quarter despite a 13 pct rise in shipments. David M. Culver, president and CEO, said the near term outlook for earnings was "not encouraging, given the continuing uncertainty as to the timing of the recovery in aluminum demand and prices."

Reynolds Metals Co.'s third quarter loss was $11.6 million, reflecting a 17.3 pct drop in shipments and a 15.9 pct drop in dollar sales volume. David P. Reynolds, its chairman, said there were signs pointing to a general economic recovery, but the aluminum producer expected the early stages would be weaker than usual, particularly in the transportation and construction markets.

Kaiser Aluminum & Chemical Corp. had a $107.3 million operating loss, but showed net income of $63.3 million because of a pre-tax gain of $180.6 million from sale of natural gas contract rights. Kaiser Chairman Cornell C. Maier said there were still "no clear, continuing signs of the kind of pickup in demand needed to improve prices" and the company expects to remain in the red during the current period.

Things weren't any better for the copper producers during the third quarter. Prices were not as severely depressed as aluminum prices were, but they were below production costs in most cases, nonetheless. The response of producers' inventory levels to stringent production cutting was just about as slow as it was in aluminum. And it wasn't until late in the third quarter that the first modest signs of lower inventories began to show up.

Phelps Dodge Corp. showed a $26.3 million loss in the third quarter which brought the nine-month deficit to $64.8 million. The company said losses continued to reflect depressed prices for copper, which it said were at a 50-year low in real terms. In addition, it does not see any return to profitability "until an economic recovery supports increased business activity among customers."

Phelps Dodge said most economists hold that such a recovery has been frustrated thus far in 1982 by "high real interest rates," and added that the recent decline in money rates was encouraging.

Revere Copper & Brass said its copper and brass fabricating operations generated profits in the third quarter, as did its aluminum extrusions and foil, utensils and specialty products operations.

What necessitated the filing under Chapter 11, said Revere President William F. Collins, was "massive and continuing losses, as well as projected further losses from its primary aluminum operations and significant, although less substantial losses, from its aluminum rolling operations."

Amax Inc., a major producer of copper, aluminum, lead, zinc, molybdenum, sustained a $97.1 million loss in the third quarter, compared with net income of $51.4 million in the same period of 1981.

Inco Ltd., the world's largest nickel producer, reported a $29.4 million net loss for the third quarter. Inco said the loss reflected lower nickel deliveries and lower prices for primary metals and alloy products. Inco's inventory of finished nickel stood at 143 million lbs going into the final quarter of 1982, down from the 157 million lbs held at midyear and the 160 million lbs in stock a year earlier.

The drop reflected stringent production curbs, including a decision early in the current period to delay the restarting of the Ontario Division facilities to April 4 from the Jan. 3 date originally scheduled. □

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METALWORKING PRICE TRENDS

Disinflation rolls on, and it looks like it will for some time.

Disinflation in metalworking product lines continued in September and, it appears from many signs, that price softening stayed right on track through October.

There is, of course, no mystery to the price-cooling trend. In September, for example, when producer prices showed a month-to-month decline, so did industrial production and plant capacity usage. Simply, prices have cooled because demand has cooled.

The U.S. Labor Dept. has noted that producer prices for finished goods declined a seasonally adjusted 0.1 pct in September. That marked the fourth month out of the last eight where these prices actually declined.

There was, however, a one-time factor at work in the September finished goods price decline. During the month, automakers sharply cut the prices they charge dealers in an effort to clear out autos as the 1982 model year came to a close. These cuts accounted for about two-thirds of the overall producer price slowdown for the month.

The sharpness of the September price cuts in motor vehicles shows up in the table here. Prices of passenger cars went down a whopping 7 pct during the month.

Notably, in September, prices of capital equipment fell 0.4 pct from the previous month. Again, it was the sharp cutback in motor vehicle prices that accounted for most of the trimming of capital goods tags. But there was still widespread price weakness in capital goods lines.

Metalworking has been bearing the brunt of the recent disinflation tide. The table shows that in September, 12 of the 21 listed metalworking product lines had actual declines in selling prices or had no price changes during the month. That number is a high for this list since the start of the price weakening move early in the year.

On a 12-month basis, the price rise for all producer finished goods came to 3.6 pct in September. In the case of the 21 metalworking product lines on the table, the 12-month average price increase came to a paltry 0.2 pct.

There are as yet few signs of firming in market demand for metalworking goods. This points to continued price softness. And with forecasts of a turnaround in the economy being generally pushed out further in time, it looks like disinflation could be around for a long time.

Latest Month Covered: September, 1982

Products	Index Reading For Month (1967 = 100)	Pct Change From Previous Month	Pct Change From Year-Ago Month
Metal Cutting Machine Tools	372.0	+ .3	+ 7.0
Metal Forming Machine Tools	410.6	− .1	+ 5.8
Agricultural Machinery & Equip.	313.6	+ .7	+ 7.1
Construction Machinery & Equip.	347.5	+ .3	+ 6.4
Industrial Process Furnace & Ovens	355.1	+ .1	+ 5.2
Industrial Material Handling Equip.	285.8	NC	+ 1.3
Pumps, Compressors & Allied Equip.	348.0	+ .1	+ 5.3
Fluid Power Equip. (Dec. 1970 = 100)	245.9	NC	+ 8.9
Mechanical Power Transmission Equip.	315.1	− .1	+ 4.8
Automobiles	201.0	+ 7.0	+ 2.5
Motor Trucks—Light	256.7	− 3.5	+10.6
Motor Trucks—Heavy	289.3	− 4.1	− .7
Railroad Equipment	354.7	NC	+ 4.7
Fabricated Metal Structural Products	304.2	− .1	+ 1.4
Electric Motors	290.8	+ .7	+ .8
Valves & Fittings	323.1	− .1	+ 2.0
Ball & Roller Bearings	335.3	NC	+ 5.4
Cutting Tools & Accessories	271.7	+ .1	+ 4.0
Heating Equipment	239.3	+ .3	+ 4.7
Plumbing Fixtures & Brass Fittings	277.0	+ .8	+ 2.0
Metal Containers	328.7	NC	+ 3.1
Miscellaneous Metal Products	289.3	+ .1	+ 5.7

Data based on U.S. Labor Dept.'s Producer Price Index

DETROIT'S BIG CHANGES UNDER THE HOOD

Lighter weight is still the main concern. As a result experimentation with alternate materials continues to move ahead through the industry.

By Bryon H. Berry

Automakers are making engines smaller, thinner, lighter, and more fuel efficient. They are using less aluminum and plastic than they predicted.

"Five or ten years ago," says Eudell G. Jacobsen, staff engineer, advanced product engineering, General Motors Technical Center, "the average engine throughout GM was almost 6mm thick. Now we're under 5mm. I'd like to see that drop below 3mm in five years. The thickness of the engine wall could drop to 1½mm and still carry the stress loads."

By contrast, the sheet metal used on car body is 1mm thick.

The 2.8-liter V6 engine introduced throughout GM in 1979 is 3mm thick, 2mm thinner than the previous V6. That saved, perhaps, just one pound in each engine. Consider the cost of processing, however, and the several million engines GM makes, and you see the magnitude of the savings.

"We're making the walls as absolutely thin as we can," says Mr. Jacobsen. "We're eliminating the excess material that we used to put on the castings to resist the pressures of broaching. The machine tool producers are reducing the pressures of the tools, including the broaches."

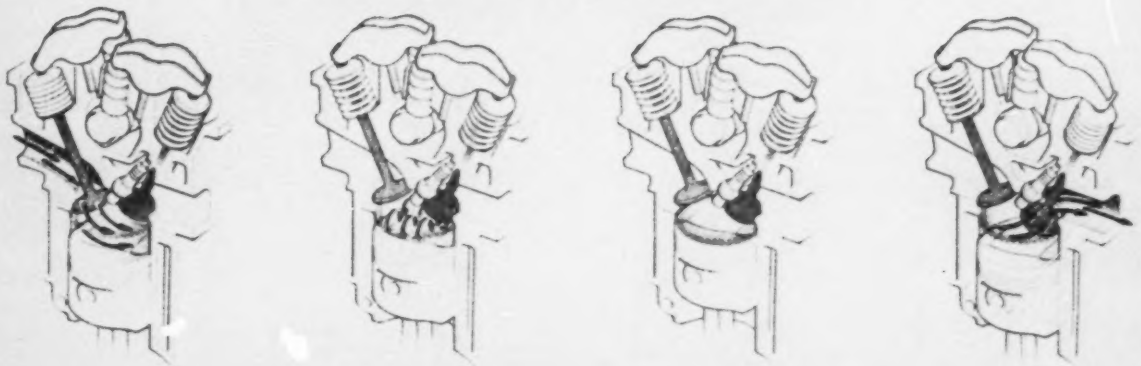
Automakers are limited only by the ability of foundries to cast thin engine walls.

"We're pushing foundry technology," says Mr. Jacobsen, "into setting cores more accurately. We're pushing the technology to use cores to make entire cylinder blocks instead of casting them in green sand."

GM and Ford are beginning to use the lost-foam method of casting. At Ford's Essex foundry in Windsor, Ont., the Styrofoam core evaporates. Left behind is the intake manifold on Ford's 3.8-liter V6 aluminum engine. Ford began pilot production with the lost-foam process earlier this year.

"We'd like to use the lost-foam method," says Henry A. Nickol, chief

Four Cycles of an Engine



A sculptured crown on the piston for the Ford Compound Valve Hemispherical (CVH) engine causes a "squish" effect on the air and fuel coming into the combustion chamber for faster, more complete combustion. The crown creates a turbulence that better mixes the air and fuel, and inhibits detonation at the outer extremes of the chamber, promoting efficient combustion and flame speed at the center. The result is improved fuel economy and reduced emissions. Drawing shows the four cycles of engine (from left to right): intake, compression, ignition, and exhaust.

powertrain and chassis engineer at Ford Motor Co.'s powertrain and chassis product engineering department, "for all our aluminum castings, particularly when the shape is intricate and surface finish important. Thus far, the quality of the castings at Essex is excellent. We'd like to use lost foam in good volume by 1985."

GM's Central Foundry is using lost-foam casting to make aluminum heads for Oldsmobile's 4.3-liter, 6-cylinder diesel engines.

Automakers also are pushing foundries to cast engines with minimal distance between the bores. They want to cut out as much space as possible without "siamesing the bores," that is, casting the bores too close together.

While asking foundries for smoother, lighter, smaller castings, automakers also are considering using sheet-metal stampings for parts usually cast. Already some accessory brackets are stamped. So are some water pumps, water-pump impellers, and enclosures.

The more complex the shape, of course, the more likely it is to be cast. Stampings are less expensive than castings, but the welding and copper brazing required to join stamped parts adds cost. In the 1940s, an entire engine was built of stampings. Its name, Cobra, stood for copper brazing.

"I don't think we'll see any more engines made entirely of stampings," says Mr. Jacobsen, "but we'll continue to study making parts by stampings instead of castings."

Automakers are using aluminum instead of iron only when they must cut weight.

"Aluminum costs about ten times more than iron," says one engineer, "on a per pound basis. On a volume basis, aluminum still is four times more expensive than iron."

All the U.S. automakers are using aluminum for the cylinder heads. None is using aluminum for the engine blocks. Overseas, however, Porsche, Mercedes Benz, and Honda are making aluminum blocks for specialty sports cars.

"There are many problems with using aluminum for an engine block," says John D. Withrow, vice president, engineering, Chrysler. "You can't use aluminum for the walls inside the cylinders, because it just won't wear. So you have to put in steel sleeves. Then you have to figure out whether to have wet or dry walls and how to keep the sleeves in place."

Ford is testing an engine made of fiber-reinforced plastic. Still, most engineers foresee no structural engine parts made of plastic in the next ten years.

"On a per pound basis," says one engineer, "plastic costs about $25 a pound and cast iron, 10 cents."

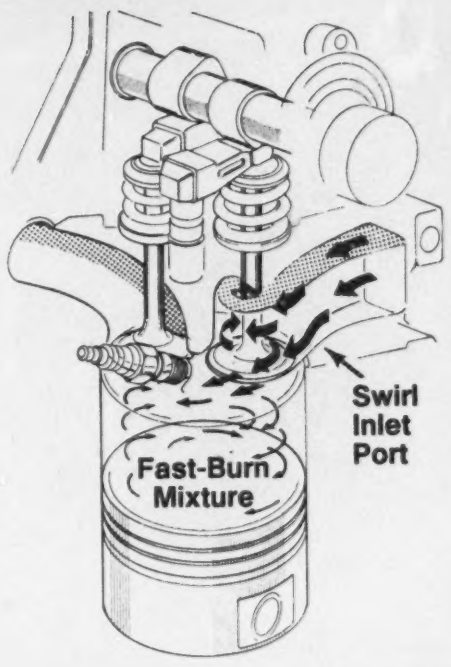
Still, automakers are saving weight by using plastic oil pans, rocker covers, electronic parts, air cleaners, ducts, housings for such parts as emission-control valves, and other accessory parts. In addition, they are using fiber-reinforced material for such parts as connecting rods, push rods, and rocker arms.

"I see an increasing usage of ceramics," says one engineer, "in the prechambers and heat shields of diesel engines. In gasoline engines, ceramics will be used to reduce friction and resist corrosion."

"Plastics have a problem maintaining shape," says another engineer. "In one project, a plastic part sagged just sitting on the shelf."

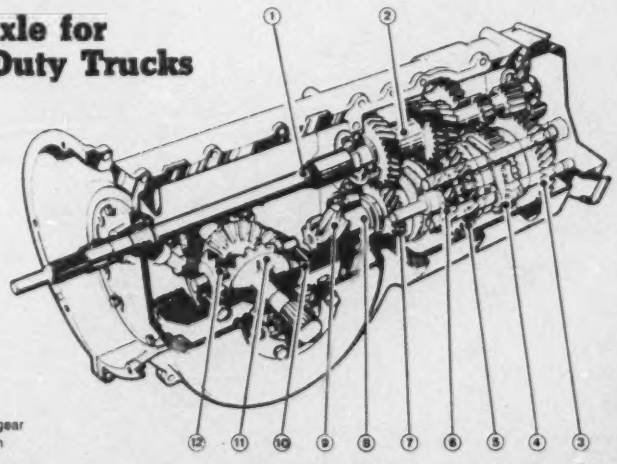
To improve manufacturing efficiency, General Motors wants to mass-produce engine bores and pistons at a common size. Presently the company allows a wider range of specifications and se-

Fast Burn



Cylinder head of Chevette 1.6-liter engine increases fuel mixture velocity and speeds the combustion process. Mixture swirls through valve opening into cylinder cavity. Faster burn allows higher compression ratio, even on regular unleaded gasoline.

Transaxle for Light Duty Trucks



1- Input shaft
2- Layshaft
3- 1st gear
4- Reverse
5- 2nd gear
6- 3rd gear
7- 4th gear
8- Mainshaft
9- Drive pinion
10- Ring gear
11- Differential side gear
12- Differential pinion

Source: Peugeot

Advances in Engine Technology

In Past Two Years Gasoline Engine Technology	Percent of Replies
Electronic controls	46
Closed-loop feedback fuel control	14
Fast-burn combustion	13
Throttle-body fuel injection	5
Lean burn	5
Size and weight reduction	4
4-6-8 engine	4
Low friction	3
Other (See Discussion)	6
	100
Diesel Engine Technology	
Fuel injection	19
Improved cold starting	16
Size and weight reduction	16
Improved emission control	14
Electronic controls	11
Other (See Discussion)	24
	100

By 1985 Gasoline Engine	Percent of Replies
Electronic controls	27
Air/fuel improvements (throttle-body injection, electronic fuel injection)	18
Combustion chamber improvements	11
Friction reduction	11
New engine materials	10
Fast burn combustion	5
Decreased accessory power requirements	5
Supercharging/turbocharging	4
Stratified charge	3
Turbulence control	3
Plastic engine materials	3
	100
Diesel Engine	
Electronic controls	26
Combustion chamber design (direct injection or open chamber)	22
Improved fuel injection	10
Supercharging/turbocharging	10
Light-weight engine	8
Particulate trap	6
Aluminum engine	5
Emission reduction	5
Improved fuel metering	4
Friction reduction	4
	100

lectively fits each piston to a bore after manufacture.

"We're trying to pay more attention," says Mr. Jacobsen, "to the precision of our surface fits and finishes and clearances. With smoother surfaces, we'll be able to use smaller bearings and reduce the friction and the ring tensions."

Ford's design engineers are going onto the plant floor to tell production workers about problems customers are having with their engines. In return, the hourly workers suggest ways to improve ease of manufacture.

Both General Motors and Chrysler are running engines of different size down the same line. On one line Chrysler can make both gas and diesel engines with three, four, five, or six cylinders and displacements from 1.5 to 2.5 liters. On another line, Chrysler can make both four- and five-speed transmissions.

Engineers at Chrysler and GM designed the critical dimensions of these engines and transmissions to be the same; only the length varies.

"We're studying a line that would flex from a V6 to a V8 and back again," says one Ford engineer, "some time in the late 1980s. That would work if we didn't have a demand high enough for either engine alone but did have enough demand for both."

All Ford's plants are using statistical process control, but not throughout the entire plant. Within three years the process should spread throughout the plants.

"The future challenges facing the auto industry," says Ford President Donald E. Petersen, "require an even greater emphasis on research and development in such crucial areas as aerodynamics, electronics, powertrain technology, new materials, alternative fuels, hybrid vehicles, and computer-aided design and manufacturing."

"There is no question," says Thomas J. Feaheny, vice president, vehicle research, engineering and research staff, "that fuel economy, or really energy efficiency, is top priority right now. In powertrain research we are looking at absolutely everything, including a lot of ideas that have been considered in the past and rejected. We're researching turbochargers and superchargers; turbo-compound engines; three-cylinder engines, two-stroke cycle engines, variable compression ratios, variable valve timing, direct injection diesel and gasoline, idle and decel shutoff and regenerative braking.

"We're looking at applications of new materials, including ceramics inside the reciprocating engine that would conserve heat and improve the thermal efficiency of the reciprocating engine; and, of course, we're also looking at ceramics on gas turbines.

"We're looking at graphite-reinforced fibers as a possible way of reducing the weight of the reciprocating engine and improving its efficiency.

"We are attacking friction and parasitic losses throughout the powertrain and the rest of the vehicle.

Fast burn is the top goal of all auto engineers working on combustion in the engine. It delivers lots of good things: no knock; fewer emissions of oxides of nitrogen (NO_x); less pumping losses; higher fuel economy; and a higher compression ratio, which means more thermodynamic efficiency.

"As you ignite the charge," says Mr. Jacobsen, "it starts burning out from that ignition source in a spherical front. As it burns out, it pushes burned gases in front of it. As they're pushed, these unburned gases get more compressed, which raises their temperature and causes them to start burning on their own, uncontrollably. They burn back in the other direction and cause collisions and vibrations—in short, knock.

"However, you can eliminate knock if you can go through the burn cycle of the fuel/air fast enough so that combustion is all over by the time the compressed gases burn back."

"There are a lot of approaches to the goal of a fast burn," says Mr. Withrow. "There's a lot of work that needs to be done in preparing the fuel/air mix, mixing it, heating it by compression, and getting it in the right position. To get fast burn, you can modify the design of the combustion chamber, intake valve, or piston. You can change the shape of the piston so that it compresses all the fuel/air at the same time toward the

By 1990	Percent of Replies
Gasoline Engine	
Electronic controls	21
New engine materials	19
Combustion chamber modification	16
Friction reduction	10
Electronic fuel injection	10
Fuel and lubricant additives	10
Stratified charge	7
Supercharging/turbocharging	7
	100
Diesel Engine	
Open combustion chamber	20
Electronic control	20
Supercharging/turbocharging	20
Ceramic materials	11
Turbo/compounding	11
Improved combustion chambers	6
Adiabatic engines	6
Other material advances	6
	100

Source: Office for Study of Automotive Transportation, University of Michigan. The university interviewed executives with automakers and suppliers of materials and parts.

spark plug. You can change the timing of the intake valve.

"The solution has to be tailored to each individual engine. There is no one right answer."

"To us," says Mr. Nickol, "fast burn is synonymous with lean burn. We can improve fuel economy 3 to 5 pct by the higher compression ratio of fast burn. All our engines will be fast-burn as fast as we can get there. Next year more than 40 pct of our engines will have some degree of fast burn.

Typical of Ford's approach to fast burn is the High Swirl Combustion (HSC) engine due next year in its Tempo/Topaz, which will replace the Fairmont/Zephyr.

"Compared to most other engines of the same displacement," says Mr. Nickol, "this 2.3-liter engine will have a 20 to 25 pct faster burn rate, get 10 to 14 pct better fuel economy, and reduce friction by 20 pct.

The fuel/air will swirl in a circular motion at a very high rate, 6000 rpm, equal to the fastest in the world. The HSC uses an overhead valve, not an overhead cam. It can be mounted under the hood either north/south or east/west, that is, either longitudinally or transversely."

"Reducing friction," says Mr. Jacobsen, "is an important goal. We can do that by lower-tension rings, valve trains, and seals; more efficient accessory drives, pumps, and pistons; smaller bearings; and lower-viscosity, friction-modified oils."

Automakers and their suppliers are cutting the horsepower that accessories soak up from the engine. An air conditioner, for example, consumes 30 pct of the fuel that powers a four-cylinder engine in a small car crossing a desert in the U.S. Southwest.

All U.S. cars likely will use throttle-body fuel-injection by 1987. Usually fuel injection is coupled with a closed-loop feedback control: a sensor in the exhaust stream that measures and optimizes the air/fuel mix.

"Virtually all passenger-car calibrations," says Mr. Nickol, "will have feedback control in order to meet the 1984 altitude emission standards."

By controlling fuel flow more precisely, fuel injection can increase horsepower, torque, and driveability.

Fuel injection is but one example of the growing number of electronic controls under the hood.

"Besides controlling the fuel/air ratio," says Mr. Withrow, "electronics can control all the other variables in the engine, including the spark, the exhaust gas recirculation (EGR), and maybe even the valve timing. Through electronics we're going to continue to tighten the noose around perfection."

"The next step in electronic controls," says Mr. Nickol, "is to use them to control the powertrain; such things as the shift points and torque converter lockup of transmissions. Next year we'll use height sensors to adjust the suspension and control the ride."

Ford has customized its electronic controls. Its 1983 models use the fourth generation of its electronic engine controls: EEC-IV. Its one microprocessor and two MROM have enough capacity to handle Ford engines through the rest of this decade.

"I forecast tremendous progress," says Mr. Nickol, "in reducing the cost and size of sensors.

"Their design and location are critical. They have to operate in all kinds of temperature, in dirt, and in oil mist."

Pressed to save weight to meet fuel-economy requirements, automakers are reconsidering turbochargers. Exhaust powers a fan, which pumps that extra fuel/air back into the engine and increases power dramatically.

The turbocharger is extremely hot—1200 to 1400 degrees F—and fast—20,000 rpm. That burns up many metals, so engineers must use a costly rare metal. An automaker might have to spend $200 to buy a turbocharger. Cost of the component and manufacture to the consumer: $400 to $600.

The high heat also increases NOx emissions.

"We figure turbocharging costs us a mile per gallon in fuel economy," says Mr. Withrow.

Both Mr. Jacobsen and Mr. Nickol say that gasoline engines likely will use turbocharging only in premium performance packages. Next year Ford will introduce a 2.3-liter, fuel-injected, turbocharged engine in the Mustang and Thunderbird.

"This package," says Mr. Nickol, "will raise the horsepower of this engine from 100 to 142 hp. By pressurizing the intake charge, we'll add six lbs of boost.

"This will be the fastest turbocharged four-cylinder engine sold in the U.S."

"Turbocharging won't be used in gas engines," says Mr. Jacobsen, "except for performance. However, it will be more widely used in diesel engines. The payback there is greater.

"A diesel engine produces significantly less power than a gas engine of the same displacement. Turbocharge the diesel, and it will produce the same power as the naturally aspirated gas engine.

"Also, the diesel combustion likes the elevated temperatures of turbocharging." Mr. Withrow takes a different approach: "We have to stop thinking about turbocharging as just for race cars. It's a way of getting a small engine to perform like a big engine." □

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MATERIALS NEWSFRONT

Price & Production Data

Steel production by districts, thousands of tons (000 omitted)

	Last Week	Two Weeks Ago	Month Ago	Year Ago
North East Coast	153	159	157	250
Buffalo	30	29	31	58
Pittsburgh	126	134	130	320
Youngstown	67	72	61	127
Cleveland	104	99	100	160
Detroit	96	95	110	152
Chicago	341	341	366	506
Cincinnati	65	68	67	96
St. Louis	57	54	51	86
Southern	73	73	74	240
Western	65	59	62	134
U.S. Production	1,177	1,183	1,209	2,129

Source: American Iron & Steel Institute

Lake Superior Ore Prices

51.50% Fe Natural delivered lower Lake ports. Rail transportation, handling and unloading may be charged to the account of the buyer. Coarse ore 80¢ premium.

Pellets (per iron unit natural)..... gross-ton 80.50-86.9*
Old range, non-bessemer ..... gross-ton $32.78
Mesabi, regular-unscreened ..... gross-ton $32.53
Mesabi, non-bessemer..... gross-ton $32.25-32.53**

*80.50¢—Pickands Mather as of 1/27/51.
**86.9¢—U. S. Steel as of 3/15/82. Cleveland-Cliffs as of 2/26/82, Oglebay Norton as of 3/25/82, and Hanna Mining as of 2/26/82.

Steel Production, Composite Prices

(Effective October 18, 1982)

U.S. Steel Production	Last Week	Two Weeks Ago	To Date 1982	To Date 1981
Net tons, in thousands	1,177	1,183	60,867	99,497
Capability Utilization Rate	39.8	40.0	49.9	81.4

Composite Prices	This Week	Week Ago	Month Ago	Year Ago
Finished Steel Base* (¢/lb.—eff. 4/4/82)	25.297	25.297	25.297	25.195
Pig Iron* * (Net ton=2000 lbs.)	$213.00	$213.00	$213.00	$203.00
Scrap No. 1 hvy.* * * (Gross ton=2240 lbs.)	$ 52.50	$ 53.50	$ 55.50	$ 82.17
No. 2 bundles	$ 39.50	$ 39.50	$ 40.50	$ 57.83

Scrap Comparison (Gross Ton)

No. 1 steel, Pittsburgh ..	$ 55.50	$ 55.50	$ 57.50	$96.50
No. 1 steel, Philadelphia	55.50	58.50	59.50	70.50
No. 1 steel, Chicago.....	46.50	46.50	49.50	79.50
No. 1 bundles, Detroit...	47.50	47.50	47.50	83.50
Low Phos., Youngstown	58.50	58.50	63.50	95.50
No. 1 mach'y cast., Pgh	66.50	66.50	71.50	94.50
No. 1 mach'y cast., Phila	98.50	98.50	98.50	117.50
No. 1 mach'y cast., Chi.	103.50	103.50	103.50	122.50

*Finished Steel Composite
Weighted index of steel bars, shapes, plates, wire, rails, black pipe, hot and cold rolled sheets and strips.

* *Pig Iron Composite
Based on average prices for basic and foundry pig iron at representative producing points within the U.S.

* * *Steel Scrap Composite
Average of No. 1 hvy. melting steel scrap and No. 2 bundles delivered to consumers at Pittsburgh, Philadelphia and Chicago.

Nonferrous Prices

(Effective October 18, 1982)
Prices obtained in trade based on representative tonnages per gross ton delivered to consumer unless otherwise stated.

Primary Metal Prices

(cents per lb.)	current price	last price	date of change
Aluminum	76.00	76.00-80.00	1/4/82
Copper (C)	71.00-72.00	70.00-72.00	10/15/82
Lead	23.00-29.00	24.00-29.00	10/5/82
Magnesium Ingot	134.00	125.00	6/1/81
Nickel	329.00	350.00	11/25/81
Titanium Sponge	555.00-585.00	555.00	4/29/82
Zinc	40.00-42.00	41.00-42.00	10/5/82

ALUMINUM: 99.5%. COPPER (C) = cathode. LEAD: common grade. MAGNESIUM: 99.8% pig, Velasco, Tex. NICKEL: electro., Port Colborne, Canada. ZINC: high grade.

Antimony, American Laredo, Texas . $2.00
Beryllium-aluminum 5% Be, per lb. contained Be $201.00
Beryllium-copper, per lb. cont. Be $121.00
Beryllium 97% powder 200 ..... $166.00
Bismuth, ton lots ..... $1.35-$1.45
Cadmium, under one ton ..... $1.05-$1.15
Calcium, ton lots, crown $3.05
Chromium, 99.8% $3.75
Cobalt, 99%, cathode $12.50
Gold per troy oz. $428.25
Indium, dollars per troy oz..... $2.85-$4.00
Iridium, dollars per troy oz..... $600
Magnesium sticks, 10,000 lbs. $1.91
Mercury, per 76-lb. f.o.b. N.Y. .. $370-$380
Molybdenum, lb. tech. moly oxides, 20 lb. MO can ..... $6.85-$8.50
Nickel oxide sinter at U.S. points of entry $3.12
Palladium, per troy oz. $140
Platinum, per troy oz..... $475
Rhodium, per troy oz. $600.00
Silver ingots, per troy oz..... $9.74
Vanadium $4.94
Zirconium sponge..... $12.00-$17.00
(Per lb. unless otherwise noted)

Straits Tin Price

(U.S. cents per lb, EX-SMELTER, based on daily market in Penang in Malaysian dollars per kilo.)

Oct. 11—556.26 Oct. 14—559.57
Oct. 12—560.89 Oct. 15—558.91
Oct. 13—559.70

Scrap Prices

Brass Mill Scrap

(Cents per lb; over 20,000 lbs. add 1¢ per lb)

	Solids	Turning
Copper	64⅛	53¼
Yellow brass	55¾	50⅝
Red brass	58¾	52¼
Comm. bronze	59½	52½
Mang. bronze	56	54¼
Free cutting rod ends	44	43

Custom Smelters Scrap

(Cents per lb., carload lots, del. refinery)

No. 1 copper wire	56
No. 2 copper wire	50
Light copper	41

Ingot Makers Scrap

(Cents per lb., carload lots, del. refinery)

No. 1 copper wire	52
No. 2 copper wire	46
Light copper	37
No. 1 composition	51
No. 1 comp. turnings	49
Hvy. yellow brass solids	32
Hvy. yellow brass turnings	25
Radiators	40

Aluminum

New mixed clips	25	—26
Old sheet	24	—25
Old cast	24	—25
Clean dry borings	24	—25

Dealers' Scrap

(Dealers' buying price f.o.b. New York in cents per pound)

Aluminum

Segregated clippings	23	—24
Mixed L.C. clips	21	—22
Old sheets and cast	15	—16
Borings and turnings	12	—13
Duraluminum clippings	22	—23

Copper and Brass

No. 1 copper wire	44	—45
No. 2 copper wire	37	—38
Light copper	32	—33
Radiators	32	—33
No. 1 composition	41	—42
No. 1 composition turn'gs	39	—40
Cocks and faucets	28	—29
Clean heavy yellow brass	24	—25
Brass Pipe	28	—29
New soft brass clippings	36	—37

Lead

Heavy soft lead	10	—11
Whole batteries	5	— 6
Type metal	15	—16
Electrotype	20	—21

Nickel

Nickel solids	115	—120
Nickel rod ends	115	—120
Nickel sheets, clips	115	—120
Nickel turnings	55	— 60

Zinc

New zinc clippings	14	—15
Old diecast zinc	7	— 8

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MATERIALS NEWSFRONT

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Ferrous Scrap Prices

Pittsburgh

No. 1 hvy. melting	$ 55.00 to $ 56.00
No. 2 hvy. melting	48.00 to 49.00
No. 1 dealer bundles	66.00 to 67.00
No. 1 factory bundles (auto)	60.00 to 61.00
No. 2 bundles	40.00 to 41.00
No. 1 busheling	69.00 to 70.00
Machine shop turn.	6.00 to 7.00
Shoveling turnings	20.00 to 21.00
Cast iron borings	18.00 to 19.00
Low phos. punchings plate	72.00 to 73.00
Heavy turnings	48.00 to 49.00
No. 1 RR hvy. melting	69.00 to 70.00
Rails 2 ft. and under	86.00 to 87.00
Scrap rails, random lgth.	82.00 to 83.00
RR specialties	73.00 to 74.00
No. 1 machinery cast	66.00 to 67.00
Cupola cast	59.00 to 60.00
Heavy breakable cast	30.00 to 31.00
Stainless	
18-8 bundles and solids	500.00 to 510.00
18-8 turnings	400.00 to 410.00

Chicago

No. 1 hvy. melting	$ 46.00 to $ 47.00
No. 2 hvy. melting	42.00 to 43.00
No. 1 dealer bundles	58.00 to 59.00
No. 1 factory bundles (auto)	60.00 to 61.00
No. 2 dealer bundles	38.00 to 39.00
Unburned bundles	42.00 to 43.00
No. 1 busheling	57.00 to 58.00
Shredder scrap	57.00 to 58.00
Machine shop turn.	14.00 to 15.00
Mixed bor. and turn.	15.00 to 16.00
Shoveling turnings	19.00 to 20.00
Cast iron borings	33.00 to 34.00
Low phos. forge crop	79.00 to 80.00
Low phos. punchings plate ¼ in. and heavier	83.00 to 84.00
Low phos. 2 ft. and under	78.00 to 79.00
No. 1 RR hvy. melting	50.00 to 51.00
Scrap rails, random lgth.	54.00 to 55.00
Reroller rails	85.00 to 86.00
Rails, 2 ft. and under	79.00 to 80.00
RR couplers and knuckles	72.00 to 73.00
RR car axles	102.00 to 103.00
No. 1 machinery cast	103.00 to 104.00
Cupola cast	89.00 to 90.00
Stove plate	76.00 to 77.00
Steel car wheels	63.00 to 64.00
Stainless	
18-8 bundles and solids	470.00 to 480.00
18-8 turnings	370.00 to 380.00
430 bundles and solids	110.00 to 120.00
430 turnings	70.00 to 75.00

Philadelphia

No. 1 hvy. melting	$ 54.00 to $ 57.00
No. 2 hvy. melting	48.00 to 51.00
No. 1 dealer bundles	65.00 to 68.00
No. 2 dealer bundles	38.00 to 41.00
No. 1 busheling	65.00 to 68.00
Shredder scrap	71.00 to 74.00
Machine shop turn.	18.00 to 21.00
Mixed bor. and turn.	18.00 to 21.00
Shoveling turnings	30.00 to 33.00
Clean cast chemical borings	40.00 to 43.00
Low phos. 5 ft. and under	62.00 to 65.00
Low phos. 2 ft. punchings	87.00 to 90.00
Electric furnace bundles	75.00 to 78.00
RR specialties	74.00 to 77.00
Rails, 2 ft. and under	89.00 to 92.00
Cupola cast	53.00 to 56.00
Heavy breakable cast	53.00 to 56.00
No. 1 machinery cast	97.00 to 100.00

Detroit

Broker buying prices per gross ton on cars:

No. 1 hvy. melting	$ 40.00 to $ 41.00
No. 2 hvy. melting	38.00 to 39.00
No. 1 dealer bundles	47.00 to 48.00
No. 2 bundles	22.00 to 23.00
No. 1 busheling	46.00 to 47.00
Drop forge flashings	26.00 to 27.00
Machine shop turn.	21.00 to 22.00
Mixed borings and turn.	13.00 to 14.00
Shoveling turnings	21.00 to 22.00
Cast iron borings	17.00 to 18.00
Heavy breakable cast	29.00 to 30.00
Mixed cupola cast	45.00 to 46.00
Automobile cast	63.00 to 64.00
Stainless	
18-8 bundles and solids	415.00 to 425.00
18-8 turnings	305.00 to 315.00
430 bundles and solids	85.00 to 95.00

Youngstown

No. 1 hvy. melting	$ 52.00 to $ 53.00
No. 2 hvy. melting	35.00 to 36.00
No. 1 dealer bundles	54.00 to 55.00
No. 2 dealer bundles	33.00 to 34.00
Machine shop turn	4.00 to 5.00
Shoveling turnings	15.00 to 16.00
Low phos. plate	58.00 to 59.00
Electric furnace bundles	58.00 to 59.00
Galvanized bundles	49.00 to 50.00

Cleveland

No. 1 hvy. melting	$ 47.00 to $ 48.00
No. 2 hvy. melting	28.00 to 29.00
No. 1 dealer bundles	56.00 to 57.00
No. 1 factory bundles	56.00 to 57.00
No. 2 bundles	24.00 to 25.00
No. 1 busheling	58.00 to 59.00
Machine shop turn.	3.00 to 4.00
Mixed bor. and turn.	3.00 to 4.00
Shoveling turnings	6.00 to 7.00
Cast iron borings	6.00 to 7.00
Cut structural & plates, 2 ft. and under	78.00 to 79.00
Low phos. punchings plate	78.00 to 79.00
Drop forge flashings	33.00 to 34.00
Foundry steel, 2 ft. & under	62.00 to 63.00
No. 1 RR hvy melting	73.00 to 74.00
Rails, 2 ft. and under	87.00 to 88.00
Rails, 18 in. and under	88.00 to 89.00
Steel axle turnings	76.00 to 77.00
Railroad cast	94.00 to 95.00
No. 1 machinery cast	99.00 to 100.00
Cupola cast	94.00 to 95.00
Stove plate	69.00 to 70.00
Stainless	
18-8 bundles	400.00 to 410.00
18-8 turnings	305.00 to 315.00
430 bundles	90.00 to 100.00

Buffalo

No. 1 hvy. melting	$ 27.00 to $ 28.00
No. 2 hvy. melting	17.00 to 18.00
No. 1 busheling	34.00 to 35.00
No. 1 dealer bundles	32.00 to 33.00
No. 2 bundles	14.00 to 15.00
Machine shop turn.	1.00 to 2.00
Mixed bor. and turn.	10.00 to 11.00
Shoveling turnings	12.00 to 13.00
Cast iron borings	10.00 to 11.00
Low phos. plate	54.00 to 55.00
Structural and plate, 2 ft. and under	52.00 to 53.00
Rails, 2 ft. and under	44.00 to 45.00
Scrap rails, random lgth.	24.00 to 25.00
No. 1 machinery cast	67.00 to 68.00
No. 1 cupola cast	46.00 to 47.00

St. Louis

No. 1 hvy. melting	$ 50.00 to $ 51.00
No. 2 hvy. melting	42.00 to 43.00
Foundry steel, 2 ft.	42.00 to 43.00
No. 1 dealer bundles	50.00 to 51.00
No. 2 bundles	39.00 to 40.00
Machine shop turn.	12.00 to 13.00
Shoveling turnings	18.00 to 19.00
Cast iron borings	30.00 to 31.00
No. 1 RR hvy. melting	50.00 to 51.00
Rails, random length	52.00 to 53.00
Rails, 18 in. and under	67.00 to 68.00
RR specialties	80.00 to 81.00
Cupola cast	70.00 to 71.00
Heavy breakable cast	48.00 to 49.00
Stove plate	70.00 to 71.00
Cast iron car wheels	49.00 to 50.00
Rerolling rails	84.00 to 85.00
Unstripped motor blocks	55.00 to 56.00

Birmingham

No. 1 heavy melting	$ 56.00 to $ 57.00
No. 2 heavy melting	53.00 to 54.00
No. 1 dealer bundles	56.00 to 57.00
No. 2 bundles	43.00 to 44.00
No. 1 busheling	51.00 to 52.00
Shredder scrap	73.00 to 74.00
Machine shop. turn.	20.00 to 21.00
Shoveling turnings	25.00 to 26.00
Cast iron borings	26.00 to 27.00
Electric furnace bundles	52.00 to 53.00
Elec. furnace, 3 ft. & under	53.00 to 54.00
Structural and plate, 2 ft.	73.00 to 74.00
Structural and plate, 4 ft.	67.00 to 68.00
No. 1 RR hvy. melting	54.00 to 55.00
Scrap rails, random lgth.	60.00 to 61.00
Rails, 18 in. and under	74.00 to 75.00
Angles and splice bars	65.00 to 66.00
No. 1 cupola cast	76.00 to 77.00
Unstripped motor blocks	55.00 to 56.00

Cincinnati

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 32.00 to $ 33.00
No. 2 hvy. melting	29.00 to 29.00
No. 1 dealer bundles	35.00 to 36.00
No. 2 bundles	23.00 to 24.00
Machine shop turn.	4.00 to 5.00
Shoveling turnings	5.00 to 6.00
Cast iron borings	7.00 to 8.00
Low phos. 18 in. and under	58.00 to 59.00
Rails, random length	38.00 to 39.00
Rails, 2 ft. and under	66.00 to 67.00
No. 1 cupola cast	47.00 to 48.00
Heavy breakable cast	22.00 to 23.00
Drop broken cast	63.00 to 64.00

New York

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 30.00 to $ 32.00
No. 2 hvy. melting	26.00 to 28.00
No. 2 dealer bundles	25.00 to 26.00
Mixed bor. and turn.	7.00 to 8.00
Machine shop turn.	9.00 to 10.00
Shoveling turnings	14.00 to 16.00
Clean cast. chem. borings	34.00 to 35.00
No. 1 machinery cast	94.00 to 95.00
Mixed yard cast	41.00 to 42.00
Heavy breakable cast	17.00 to 18.00
Stainless	
18-8 prepared solids	440.00 to 450.00
18-8 turnings	375.00 to 400.00
430 prepared solids	90.00 to 100.00
410 solids	80.00 to 90.00

Boston

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 33.00 to $ 35.00
No. 2 hvy. melting	23.00 to 25.00
No. 1 dealer bundles	35.00 to 37.00
No. 2 bundles	20.00 to 22.00
No. 1 busheling	35.00 to 37.00
Shredder scrap	45.00 to 47.00
Machine shop turn.	1.00 to 2.00
Shoveling turnings	3.00 to 5.00
No. 1 machinery cast	100.00 to 105.00
Mixed cupola cast	28.00 to 30.00
Heavy breakable cast	4.00 to 6.00

San Francisco

No. 1 hvy. melting	$ 41.00 to $ 43.00
No. 2 hvy. melting	33.00 to 35.00
No. 1 dealer bundles	28.00 to 30.00
No. 2 dealer bundles	13.00 to 15.00
Machine shop turn.	5.00 to 7.00
Cast iron borings	5.00 to 7.00
No. 1 cupola cast	85.00 to 87.00

Los Angeles

No. 1 hvy. melting	$ 40.00 to $ 42.00
No. 2 hvy. melting	29.00 to 31.00
No. 1 dealer bundles	27.00 to 29.00
No. 2 dealer bundles	10.00 to 12.00
Machine shop turn.	5.00 to 7.00
Shoveling turnings	9.00 to 11.00
Cast iron borings	5.00 to 7.00
Elec. furnace, 1 ft. and under (foundry)	87.00 to 89.00
No. 1 cupola cast	89.00 to 91.00

Seattle

No. 1 hvy. melting	$ 56.00 to $ 58.00
No. 2 hvy. melting	45.00 to 47.00
No. 2 bundles	35.00 to 37.00
No. 1 cupola cast	91.00 to 93.00
Mixed yard cast	81.00 to 83.00

Hamilton, Ont.

Brokers buying price per net ton on cars:

No. 1 heavy melting	$ 43.00
No. 2 heavy melting cut 2 ft. and under	40.00
No. 1 dealer bundles	50.00
No. 2 bundles	8.00
Mixed steel scrap	22.00
Bush. new fact. prep'd.	48.00
Bush. new fact. unprp'd.	40.00
Machine shop turn.	23.00
Short steel turn.	26.00
Mixed bor. and turn.	15.00
Cast scrap	35.00

Houston

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 55.00 to $ 56.00
No. 2 hvy. melting	43.00 to 44.00
No. 2 bundles	28.00 to 30.00
Machine shop turn.	8.00 to 9.00
Crushed turnings	22.00 to 24.00
Shredder scrap	55.00 to 56.00
Cut structural plate 2 ft. and under	77.00 to 78.00
Unstripped motor blocks	55.00 to 57.00
Cupola cast	64.00 to 66.00

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EFFECTIVE OCTOBER 25, 1982

MATERIALS NEWSFRONT

Price & Production Data

Steel production by districts, thousands of tons (000 omitted)

	Last Week	Two Weeks Ago	Month Ago	Year Ago
North East Coast	116	153	163	228
Buffalo	30	30	29	59
Pittsburgh	137	126	123	317
Youngstown	67	67	60	140
Cleveland	95	104	96	164
Detroit	103	96	107	148
Chicago	333	341	361	495
Cincinnati	64	65	54	105
St. Louis	55	57	57	87
Southern	61	73	72	216
Western	50	65	58	136
U.S. Production	1,111	1,177	1,180	2,095

Source: American Iron & Steel Institute

Lake Superior Ore Prices

51.50% Fe Natural delivered lower Lake ports. Rail transportation, handling and unloading may be charged to the account of the buyer. Coarse ore 80¢ premium.

Pellets (per iron unit natural)..... gross-ton 80.50-86.9*
Old range, non-bessemer ..... gross-ton $32.78
Mesabi, regular-unscreened ..... gross-ton $32.53
Mesabi, non-bessemer.....gross-ton $32.25-32.53**

*80.50¢—Pickands Mather as of 1/27/81.
**86.9¢—U. S. Steel as of 3/15/82, Cleveland-Cliffs as of 2/26/82, Oglebay Norton as of 3/25/82, and Hanna Mining as of 2/26/82.

Steel Production, Composite Prices

(Effective October 25, 1982)

U.S. Steel Production	Last Week	Two Weeks Ago	To Date 1982	To Date 1981
Net tons, in thousands	1,111	1,177	62,173	101,479
Capability Utilization Rate	37.6	39.8	49.8	81.1

Composite Prices	This Week	Week Ago	Month Ago	Year Ago
Finished Steel Base* (¢/lb.—eff. 4/4/82)	25.297	25.297	25.297	25.195
Pig Iron** (Net ton=2000 lbs.)	$213.00	$213.00	$213.00	$203.00
Scrap No. 1 hvy.*** (Gross ton=2240 lbs.)	$ 52.17	$ 52.50	$ 53.50	$ 82.17
No. 2 bundles	$ 39.17	$ 39.50	$ 39.50	$ 57.17

Scrap Comparison (Gross Ton)				
No. 1 steel, Pittsburgh	$ 54.50	$ 55.50	$ 55.50	$94.50
No. 1 steel, Philadelphia	55.50	55.50	58.50	70.50
No. 1 steel, Chicago	46.50	46.50	46.50	81.50
No. 1 bundles, Detroit	44.50	47.50	47.50	83.50
Low Phos., Youngstown	56.50	58.50	58.50	95.50
No. 1 mach'y cast., Pgh	64.50	66.50	71.50	94.50
No. 1 mach'y cast., Phila	98.50	98.50	98.50	117.50
No. 1 mach'y cast., Chi.	103.50	103.50	103.50	120.50

*Finished Steel Composite
Weighted index of steel bars, shapes, plates, wire, rails, black pipe, hot and cold rolled sheets and strips.

**Pig Iron Composite
Based on average prices for basic and foundry pig iron at representative producing points within the U.S.

***Steel Scrap Composite
Average of No. 1 hvy. melting steel scrap and No. 2 bundles delivered to consumers at Pittsburgh, Philadelphia and Chicago.

Nonferrous Prices

(Effective October 25, 1982)
Prices obtained in trade based on representative tonnages per gross ton delivered to consumer unless otherwise stated.

Primary Metal Prices

(cents per lb.)	current price	last price	date of change
Aluminum	76.00	76.00-80.00	1/4/82
Copper (C)	72.00	71.00-72.00	10/19/82
Lead	23.00-26.00	23.00-29.00	10/22/82
Magnesium Ingot	134.00	125.00	6/1/81
Nickel	329.00	350.00	11/25/81
Titanium Sponge	555.00-585.00	555.00	4/29/82
Zinc	40.00-42.00	41.00-42.00	10/5/82

ALUMINUM: 99.5%. COPPER (C) = cathode. LEAD: common grade. MAGNESIUM: 99.8% pig. Velasco, Tex. NICKEL: electro., Port Colborne, Canada. ZINC: high grade.

Antimony, American Laredo, Texas .$2.00
Beryllium-aluminum 5% Be, per lb. contained Be.....$201.00
Beryllium-copper, per lb. cont. Be$121.00
Beryllium 97% powder 200.....$166.00
Bismuth, ton lots .....$1.35-$1.45
Cadmium, under one ton .....$1.05-$1.15
Calcium, ton lots, crown $3.05
Chromium, 99.8% $3.75
Cobalt, 99%, cathode.....$12.50
Gold per troy oz. $418.60
Indium, dollars per troy oz.....$2.85-$4.00
Iridium, dollars per troy oz.....$600
Magnesium sticks, 10,000 lbs. $1.91
Mercury, per 76-lb. f.o.b. N.Y. ..$370-$380
Molybdenum, lb. tech. moly oxides, 20 lb. MO can .....$6.85-$8.50
Nickel oxide sinter at U.S. points of entry $3.12
Palladium, per troy oz. $140
Platinum, per troy oz.....$475
Rhodium, per troy oz.....$600.00
Silver ingots, per troy oz.....$10.11
Vanadium $4.94
Zirconium sponge.....$12.00-$17.00
(Per lb. unless otherwise noted)

Straits Tin Price

(U.S. cents per lb. EX-SMELTER, based on daily market in Penang in Malaysian dollars per kilo.)

Oct. 18—Holiday
Oct. 19—558.91
Oct. 20—557.85
Oct. 21—557.59
Oct. 22—559.57

Scrap Prices

Brass Mill Scrap

(Cents per lb; over 20,000 lbs. add 1¢ per lb)

	Solids	Turning
Copper	67½	58¼
Yellow brass	59¼	54⅛
Red brass	63	56½
Comm. bronze	64	57
Mang. bronze	58⅞	57⅛
Free cutting rod ends	44	43

Custom Smelters Scrap

(Cents per lb., carload lots, del. refinery)

No. 1 copper wire	57
No. 2 copper wire	51
Light copper	42

Ingot Makers Scrap

(Cents per lb., carload lots, del. refinery)

No. 1 copper wire	57
No. 2 copper wire	51
Light copper	42
No. 1 composition	53
No. 1 comp. turnings	47
Hvy. yellow brass solids	38
Hvy. yellow brass turnings	25
Radiators	41

Aluminum

New mixed clips	25	—26
Old sheet	24	—25
Old cast	24	—25
Clean dry borings	24	—25

Dealers' Scrap

(Dealers' buying price f.o.b. New York in cents per pound)

Aluminum

Segregated clippings	23	—24
Mixed L.C. clips	21	—22
Old sheets and cast	15	—16
Borings and turnings	12	—13
Duraluminum clippings	22	—23

Copper and Brass

No. 1 copper wire	44	—45
No. 2 copper wire	37	—38
Light copper	32	—33
Radiators	32	—33
No. 1 composition	41	—42
No. 1 composition turn'gs	39	—40
Cocks and faucets	28	—29
Clean heavy yellow brass	24	—25
Brass Pipe	28	—29
New soft brass clippings	36	—37

Lead

Heavy soft lead	10	—11
Whole batteries	5	— 6
Type metal	15	—16
Electrotype	20	—21

Nickel

Nickel solids	115	—120
Nickel rod ends	115	—120
Nickel sheets, clips	115	—120
Nickel turnings	55	— 60

Zinc

New zinc clippings	14	—15
Old diecast zinc	7	— 8

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EFFECTIVE OCTOBER 25, 1982 MATERIALS NEWSFRONT

(Effective October 25, 1982) Prices obtained in trade based on representative tonnages per gross ton delivered to consumer unless otherwise stated. Prices are the opinions of *Iron Age* editors and correspondents, based on contacts with dealers, brokers, generators and users in the industry on the effective date listed above.

Ferrous Scrap Prices

Pittsburgh

No. 1 hvy. melting	$ 54.00 to $ 55.00
No. 2 hvy. melting	48.00 to 49.00
No. 1 dealer bundles	65.00 to 66.00
No. 1 factory bundles (auto)	60.00 to 61.00
No. 2 bundles	39.00 to 40.00
No. 1 busheling	65.00 to 66.00
Machine shop turn.	6.00 to 7.00
Shoveling turnings	20.00 to 21.00
Cast iron borings	18.00 to 19.00
Low phos. punchings plate	69.00 to 70.00
Heavy turnings	48.00 to 49.00
No. 1 RR hvy. melting	69.00 to 70.00
Rails 2 ft. and under	86.00 to 87.00
Scrap rails, random lgth.	82.00 to 83.00
RR specialties	73.00 to 74.00
No. 1 machinery cast	64.00 to 65.00
Cupola cast	57.00 to 58.00
Heavy breakable cast	30.00 to 31.00
Stainless	
18-8 bundles and solids	490.00 to 500.00
18-8 turnings	390.00 to 400.00

Chicago

No. 1 hvy. melting	$ 46.00 to $ 47.00
No. 2 hvy. melting	42.00 to 43.00
No. 1 dealer bundles	58.00 to 59.00
No. 1 factory bundles (auto)	60.00 to 61.00
No. 2 dealer bundles	38.00 to 39.00
No. 1 busheling	57.00 to 58.00
Shredder scrap	57.00 to 58.00
Machine shop turn.	14.00 to 15.00
Mixed bor. and turn.	15.00 to 16.00
Shoveling turnings	19.00 to 20.00
Cast iron borings	33.00 to 34.00
Low phos. forge crop	79.00 to 80.00
Low phos. punchings plate ¼ in. and heavier	83.00 to 84.00
Low phos. 2 ft. and under	78.00 to 79.00
No. 1 RR hvy. melting	50.00 to 51.00
Scrap rails, random lgth.	54.00 to 55.00
Reroller rails	85.00 to 86.00
Rails, 2 ft. and under	79.00 to 80.00
RR couplers and knuckles	72.00 to 73.00
RR car axles	102.00 to 103.00
No. 1 machinery cast	103.00 to 104.00
Cupola cast	89.00 to 90.00
Stove plate	76.00 to 77.00
Steel car wheels	63.00 to 64.00
Stainless	
18-8 bundles and solids	460.00 to 470.00
18-8 turnings	360.00 to 370.00
430 bundles and solids	105.00 to 115.00
430 turnings	70.00 to 75.00

Philadelphia

No. 1 hvy. melting	$ 54.00 to $ 57.00
No. 2 hvy. melting	48.00 to 51.00
No. 1 dealer bundles	65.00 to 68.00
No. 2 dealer bundles	38.00 to 41.00
No. 1 busheling	65.00 to 68.00
Shredder scrap	71.00 to 74.00
Machine shop turn.	18.00 to 21.00
Mixed bor. and turn.	18.00 to 21.00
Shoveling turnings	30.00 to 33.00
Clean cast chemical borings	40.00 to 43.00
Low phos. 5 ft. and under	62.00 to 65.00
Low phos. 2 ft. punchings	87.00 to 90.00
Electric furnace bundles	75.00 to 78.00
RR specialties	74.00 to 77.00
Rails, 2 ft. and under	89.00 to 92.00
Cupola cast	53.00 to 56.00
Heavy breakable cast	53.00 to 56.00
No. 1 machinery cast	97.00 to 100.00

Detroit

Broker buying prices per gross ton on cars:

No. 1 hvy. melting	$ 37.00 to $ 38.00
No. 2 hvy. melting	35.00 to 36.00
No. 1 dealer bundles	44.00 to 45.00
No. 2 bundles	19.00 to 20.00
No. 1 busheling	43.00 to 44.00
Drop forge flashings	24.00 to 25.00
Machine shop turn.	21.00 to 22.00
Mixed borings and turn.	13.00 to 14.00
Shoveling turnings	21.00 to 22.00
Cast iron borings	14.00 to 15.00
Heavy breakable cast	24.00 to 25.00
Mixed cupola cast	40.00 to 41.00
Automobile cast	58.00 to 59.00
Stainless	
18-8 bundles and solids	415.00 to 425.00
18-8 turnings	305.00 to 315.00
430 bundles and solids	85.00 to 95.00

Youngstown

No. 1 hvy. melting	$ 49.00 to $ 50.00
No. 2 hvy. melting	32.00 to 33.00
No. 1 dealer bundles	51.00 to 52.00
No. 2 dealer bundles	30.00 to 31.00
Machine shop turn.	3.00 to 4.00
Shoveling turnings	9.00 to 10.00
Low phos. plate	56.00 to 57.00
Electric furnace bundles	56.00 to 57.00
Galvanized bundles	44.00 to 45.00

Cleveland

No. 1 hvy. melting	$ 47.00 to $ 48.00
No. 2 hvy. melting	28.00 to 29.00
No. 1 dealer bundles	56.00 to 57.00
No. 1 factory bundles	56.00 to 57.00
No. 2 bundles	24.00 to 25.00
No. 1 busheling	58.00 to 59.00
Machine shop turn.	3.00 to 4.00
Mixed bor. and turn.	3.00 to 4.00
Shoveling turnings	6.00 to 7.00
Cast iron borings	6.00 to 7.00
Cut structural & plates, 2 ft. and under	78.00 to 79.00
Low phos. punchings plate	78.00 to 79.00
Drop forge flashings	33.00 to 34.00
Foundry steel, 2 ft. & under	62.00 to 63.00
No. 1 RR hvy melting	73.00 to 74.00
Rails, 2 ft. and under	87.00 to 88.00
Rails, 18 in. and under	88.00 to 89.00
Steel axle turnings	76.00 to 77.00
Railroad cast	94.00 to 95.00
No. 1 machinery cast	94.00 to 95.00
Cupola cast	94.00 to 95.00
Stove plate	69.00 to 70.00
Stainless	
18-8 bundles	400.00 to 410.00
18-8 turnings	305.00 to 315.00
430 bundles	90.00 to 100.00

Buffalo

No. 1 hvy. melting	$ 27.00 to $ 28.00
No. 2 hvy. melting	17.00 to 18.00
No. 1 busheling	34.00 to 35.00
No. 1 dealer bundles	32.00 to 33.00
No. 2 bundles	14.00 to 15.00
Machine shop turn.	1.00 to 2.00
Mixed bor. and turn.	10.00 to 11.00
Shoveling turnings	12.00 to 13.00
Cast iron borings	10.00 to 11.00
Low phos. plate	54.00 to 55.00
Structural and plate, 2 ft. and under	52.00 to 53.00
Rails, 2 ft. and under	44.00 to 45.00
Scrap rails, random lgth.	24.00 to 25.00
No. 1 machinery cast	67.00 to 68.00
No. 1 cupola cast	46.00 to 47.00

St. Louis

No. 1 hvy. melting	$ 50.00 to $ 51.00
No. 2 hvy. melting	42.00 to 43.00
Foundry steel, 2 ft.	42.00 to 43.00
No. 1 dealer bundles	50.00 to 51.00
No. 2 bundles	39.00 to 40.00
Machine shop turn.	12.00 to 13.00
Shoveling turnings	18.00 to 19.00
Cast iron borings	30.00 to 31.00
No. 1 RR hvy. melting	50.00 to 51.00
Rails, random length	52.00 to 53.00
Rails, 18 in. and under	67.00 to 68.00
RR specialties	80.00 to 81.00
Cupola cast	70.00 to 71.00
Heavy breakable cast	48.00 to 49.00
Stove plate	70.00 to 71.00
Cast iron car wheels	49.00 to 50.00
Rerolling rails	84.00 to 85.00
Unstripped motor blocks	55.00 to 56.00

Birmingham

No. 1 heavy melting	$ 56.00 to $ 57.00
No. 2 heavy melting	53.00 to 54.00
No. 1 dealer bundles	56.00 to 57.00
No. 2 bundles	43.00 to 44.00
No. 1 busheling	51.00 to 52.00
Shredder scrap	73.00 to 74.00
Machine shop. turn.	20.00 to 21.00
Shoveling turnings	25.00 to 26.00
Cast iron borings	26.00 to 27.00
Electric furnace bundles	52.00 to 53.00
Elec. furnace, 3 ft. & under	53.00 to 54.00
Structural and plate, 2 ft.	73.00 to 74.00
Structural and plate, 4 ft.	67.00 to 68.00
No. 1 RR hvy. melting	54.00 to 55.00
Scrap rails, random lgth.	60.00 to 61.00
Rails, 18 in. and under	74.00 to 75.00
Angles and splice bars	65.00 to 66.00
No. 1 cupola cast	76.00 to 77.00
Unstripped motor blocks	55.00 to 56.00

Cincinnati

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 30.00 to $ 31.00
No. 2 hvy. melting	28.00 to 29.00
No. 1 dealer bundles	31.00 to 32.00
No. 2 bundles	20.00 to 21.00
Machine shop turn.	2.00 to 3.00
Shoveling turnings	4.00 to 5.00
Cast iron borings	5.00 to 6.00
Low phos. 18 in. and under	57.00 to 58.00
Rails, random length	37.00 to 38.00
Rails, 2 ft. and under	64.00 to 65.00
No. 1 cupola cast	45.00 to 46.00
Heavy breakable cast	21.00 to 22.00
Drop broken cast	60.00 to 61.00

New York

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 28.00 to $ 29.00
No. 2 hvy. melting	24.00 to 26.00
No. 2 dealer bundles	23.00 to 24.00
Mixed bor. and turn.	7.00 to 8.00
Machine shop turn.	4.00 to 5.00
Shoveling turnings	10.00 to 12.00
Clean cast. chem. borings	34.00 to 35.00
No. 1 machinery cast	89.00 to 90.00
Mixed yard cast	38.00 to 39.00
Heavy breakable cast	14.00 to 15.00
Stainless	
18-8 prepared solids	440.00 to 450.00
18-8 turnings	375.00 to 400.00
430 prepared solids	90.00 to 100.00
410 solids	80.00 to 90.00

Boston

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 30.00 to $ 32.00
No. 2 hvy. melting	20.00 to 22.00
No. 1 dealer bundles	32.00 to 34.00
No. 2 bundles	20.00 to 22.00
No. 1 busheling	32.00 to 34.00
Shredder scrap	43.00 to 44.00
Machine shop turn.	1.00 to 2.00
Shoveling turnings	2.00 to 4.00
No. 1 machinery cast	100.00 to 105.00
Mixed cupola cast	25.00 to 27.00
Heavy breakable cast	4.00 to 6.00

San Francisco

No. 1 hvy. melting	$ 41.00 to $ 43.00
No. 2 hvy. melting	33.00 to 35.00
No. 1 dealer bundles	28.00 to 30.00
No. 2 dealer bundles	13.00 to 15.00
Machine shop turn.	5.00 to 7.00
Cast iron borings	5.00 to 7.00
No. 1 cupola cast	85.00 to 87.00

Los Angeles

No. 1 hvy. melting	$ 40.00 to $ 42.00
No. 2 hvy. melting	29.00 to 31.00
No. 1 dealer bundles	27.00 to 29.00
No. 2 dealer bundles	10.00 to 12.00
Machine shop turn.	5.00 to 7.00
Shoveling turnings	9.00 to 11.00
Cast iron borings	5.00 to 7.00
Elec. furnace, 1 ft. and under (foundry)	87.00 to 89.00
No. 1 cupola cast	89.00 to 91.00

Seattle

No. 1 hvy. melting	$ 56.00 to $ 58.00
No. 2 hvy. melting	45.00 to 47.00
No. 2 bundles	35.00 to 37.00
No. 1 cupola cast	91.00 to 93.00
Mixed yard cast	81.00 to 83.00

Hamilton, Ont.

Brokers buying price per net ton on cars:

No. 1 heavy melting	$ 43.00
No. 2 heavy melting cut 2 ft. and under	40.00
No. 1 dealer bundles	50.00
No. 2 bundles	8.00
Mixed steel scrap	22.00
Bush. new fact. prep'd.	48.00
Bush. new fact. unprp'd.	40.00
Machine shop turn.	23.00
Short steel turn.	26.00
Mixed bor. and turn.	15.00
Cast scrap	35.00

Houston

Brokers buying prices per gross ton on cars:

No. 1 hvy. melting	$ 55.00 to $ 56.00
No. 2 hvy. melting	43.00 to 44.00
No. 2 bundles	28.00 to 30.00
Machine shop turn.	8.00 to 9.00
Crushed turnings	22.00 to 24.00
Shredder scrap	55.00 to 56.00
Cut structural plate 2 ft. and under	77.00 to 78.00
Unstripped motor blocks	55.00 to 57.00
Cupola cast	64.00 to 66.00